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MEDICUS

CHOLERA.

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CHOLERA*

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Gentlemen:—I offer no apology for studying with you the book knowledge of a disease so important as cholera. A disease that may in a few months confront us all, and one which in its progress may lessen the membership of this society. "To be forewarned is to be forearmed."

Cholera is an acute, specific, infectious disease, chiefly prevailing as a virulent epidemic and having for its typical symptoms, profuse watery diarrhea, vomiting, prostration to total collapse, cramp in the muscles and suppression of urine.

We find mention of a disease similar in all respects to cholera, in early Sanscrit and Chinese writings, and it is spoken of by Hippocrates and by many of the early fathers of medicine. None of these sources of information speak of cholera as an epidemic disease and we have no record of a cholera epidemic until the seventeenth century. The home of genuine Asiatic cholera is in India. It is there endemic.

The first wide-spread epidemic, of which we have positive knowledge, occurred in 1817, seventy-six years ago. During this epidemic 10,000 deaths took place in and about Jessora, India, in less than two months time. From this nucleus, cholera spread in all directions and reached in its course, Persia and China. It continued to spread, being arrested now and then by cold, only to renew its journey after a sleep. In 1832 it reached London. That was in February. In July of 1832, New York presented its first case. Then for two years it spread southward and from Montreal it passed westward along the great lakes and then down the Missis-

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issippi Valley, reaching Mexico in February 1833. In this country its course from place to place was the same as in Europe, along the principal high and water ways. Every place of importance was visited and its ravages on this continent extended from Canada to Yucatan. In Europe the epidemic continued to spread for a period of five years. It then slowly died out. On the continent there were two countries spared, Greece, and especially worthy of note to us, Switzerland. Whether its immunity was due to its sparse settlement and its non-communication with the world, or to its elevated altitude, its rarefied atmosphere and dryness, is a question which concerns us. In many respects Colorado and Switzerland well resemble each other and to us comes the question, will we be exempt from the coming epidemic.

This epidemic was followed in 1845, full twelve years after the last of the first epidemic, by a second cholera scourge, which once again started from the border of the Ganges and following about the same course as the preceding one, spread over Europe in this and the following years. It reached New York and New Orleans in the fall of 1848. At New York it was arrested at quarantine, but at New Orleans it escaped the officials, and passed up the Mississippi Valley and finally reached San Francisco. Denver was but a trading post at that time and no cases of cholera occurred here or throughout the territory during that epidemic.

In 1873 the United States was visited by a third outbreak of cholera, which for a time was very severe. It entered by the way of New Orleans and was preceded by a prevalence of the disease in Europe for at least three years. From New Orleans it spread throughout the Mississippi Valley and the adjoining states.

The places visited by cholera vary a great deal. Every portion of the globe has been visited by this dire disease, except the polar regions. High and dry altitudes have not escaped, the disease in India has repeatedly extended over a high plateau, and even mountain regions have not escaped. Dryness of atmosphere does however modify its virulence as we will see.

In every country the progress of cholera is along the routes of

travel, along the rivers, the sea-shore and the great land routes.

In some epidemics it extends from place to place with great rapidity. Yet it never extends faster than man moves. It is carried by travel and never moves faster than travel.

Cholera extension has no relation with the prevailing winds; it has been known to travel against the wind with great rapidity. Winter always arrests an epidemic of cholera. This has been true of every epidemic of which we have any record.

The arrest is occasionally a permanent one, but usually the return of warm weather brings a renewal of the disease.

All epidemics of this disease present a movement of increase, a stationary period and a stage of decline.

Facts and facts of interest could be added to any extent concerning the movements of cholera epidemics, but enough has been mentioned at this time. The subject is one of great interest.

ETIOLOGY:—One of the most interesting and vital points in the consideration of cholera is its etiology. From its wide prevalence, from its behavior, from the means by which it spread, it became evident that the real cause of the disease was the infection of the system by a specific micro-organism.

Koch, the master hand in bacteriology, was put in charge of a scientific expedition sent out by the German Government in 1883 to Egypt and India, where the disease was then epidemic, for the purpose of investigating this disease. He worked in India during the winter and spring of 1884, and his work has since been continued in Berlin and although not entirely completed, the results thus far obtained are as follows: In the intestines of all the victims of cholera whose bodies he examined, he found a peculiar shaped micro-organism, new to him, which he named the comma bacillus. This bacillus was found in the intestinal fluids, almost in pure cultures at times, in Peyer's patches and intestinal glands of cholera patients and in no other cases.

It is shorter than the bacillus of tuberculosis, but somewhat thicker and it is usually bent in the shape of a comma, or even like a semi-circle.

The cholera germ is not a bacillus, but belongs to the spirilli. This is especially seen when it forms groups or colonies, then neatly turned screws or long spirilla arise. In examining cholera preparations the developed spirilla are not frequently met with. They seem to arise only under special circumstances, usually when their rapid development is in some way disturbed. As a rule in cholera preparations two spirilla are often seen together, growing end to end, the curves facing in different directions, resembling the letter s.

They possess an extremely lively motion when cultivated at a suitable temperature and in proper nourishment. They crowd and whirl through the microscopic field "like a swarm of dancing gnats."

As yet it is not fully known whether the "comma bacillus," a name which is retained on account of its historical significance, forms spores or not.

It has been ascertained that the comma bacillus is among the most sensitive micro-organisms known. High temperature (above 130 °F.) kills them with certainty in a short time; they cannot withstand the action of chemical agents, especially acids. The acids of the gastric juice destroy them absolutely; they do not thrive on gelatin containing a trace of acid. On drying their destruction is soon brought about. While they may retain the power of development for months in moist surroundings, they perish in a dry condition frequently within a few hours. In this respect they die more quickly than most other micro organisms.

As to the ability of the comma bacilli to resist the presence of other bacteria and of struggling for existence in rivalry with them, Koch has ascertained that they are overpowered and quickly disappear in putrescent liquids.

The spirillum requires oxygen for its growth, and in the intestines gets it by breaking up molecules there present. When this spirillum is placed upon the gelatin plate, after the usual time, small white spots deep in the gelatin can be seen with the naked eye. These gradually advance to the surface and then cause a rather slow liquefaction of the gelatin, into which the colony settles and it can be seen at the bottom as a whitish mass, scarcely the size

of a pin's head. This mass looks like a tiny heap of broken glass.

A test tube culture shows growth along the entire line of inoculation, but liquefaction takes place more extensively at the surface of the gelatine. A funnel is formed, the principal mass of the culture accumulates close to its stem, the central portion of the inoculating puncture appears as an almost empty shining thread, and the bacteria descend into the lower third of the puncture where they settle as yellowish white masses loosely curled.

The cholera spirilla thrive and multiply in milk without perceptibly changing the fluid, a fact to be considered in connection with their transmission to man. As soon as milk sours the cholera spirillum is destroyed by the lactic acid thus produced.

The comma bacilli can sustain themselves in sterilized water, no matter whether it is obtained from river, well or aqueduct. In non-sterilized water, the cholera bacteria are almost fully dislodged in a few days by existing micro-organisms. To day we have a chemical test for the presence of the specific cholera poison. By treating comma bacilli cultures grown in bouillon containing peptone, with a small quantity of perfectly pure sulphuric acid free from nitrates, there shortly appears in the solution a reddish-violet discoloration, due to the indol reaction. Other bacteria give this, but only after impure nitric acid or nitrates have been added. The point distinguishing the cholera bacteria is their production of the nitrous combinations, which are necessary for the reaction.

The cholera spirillum flourishes best at a temperature between 86° and 104°F. Below 61°F. they cease to grow, but they are not killed even by a greater degree of cold. Freezing for a short time does not effect them. If exposed to temperatures near zero point for from 6 to 12 hours they do not survive. A temperature of 130°F. kills them with a certainty.

The organism is found only in the intestines of the cholera patients and not in the blood or other fluids of the body. Repeated search has failed to show its presence in any other form of gastro-intestinal disease, such as dysentery, enteritis or cholera-morbus. The link in the chain of evidence connecting it with cholera as a

specific cause, successful inoculation experiments, has also been made. The inoculation is made by introducing one-hundredth of a drop of a pure culture of the organism into the duodenum of rabbits and guinea pigs, after special preparation, with the result of death in from 1 to 3 days, with some of the symptoms of cholera all the pathological lesion of that disease, and the discovery of masses of the bacilli in the intestinal fluids and on the intestinal wall.

Having such positive knowledge as to the causation of this disease, let us see under what circumstances and through what channels do the comma bacilli penetrate into the human system and in what manner do they there excite the characteristic processes of the disease.

There can be no doubt that with us cholera is always imported; it is equally certain that the dejecta thrown off by cholera patients are rich in comma bacilli, of course along with bacteria of other kinds, and that these dejections are the chief if not the only agent by which cholera is disseminated.

The spirilla escape with the stool, and prolong their existence by living upon the organic matter of the stool and upon such nourishment as they may be brought into contact with. They continue to grow upon moistened bed-clothes, in food and in moist earth. The ways by which they in turn enter the system are infinite.

We have seen that cholera progresses always along the world's most frequented highways, and that it never travels faster than the means of human intercommunication render possible. This is important, showing very clearly that the germs of the disease are not disseminated by currents of air. It is thought that a dense fog, driven by wind, might carry the germ, but even this is improbable. The distribution of cholera, has in a few epidemics corresponded with that of water destined for personal use. We can readily understand why it has been so.

Apparently in every case, the cholera poison enters the intestinal canal. The comma bacilli are never found outside of the

intestines, never in the blood, never in the other internal viscera. We must therefore suppose that the bacilli are swallowed with food or drink, that they escape the gastric juice of the stomach and at once begin to multiply with great rapidity in the intestines. Their growth is very rapid as we could well understand from the symptoms alone. The bacillus is of course of vegetable origin. In apparent agreement with its growth in the intestines is the frequently observed fact that every gastric catarrh, however acquired, existing at the time of a cholera epidemic, predisposes to the disease.

Cholera epidemics generally happen in the summer and liability to the disease is very wide spread. Sex is about equally predisposed. As regards age, adult life is especially prone to the disease. Babies and children are occasionally attacked. Among the predisposing causes on which greatest stress must be laid, are: 1. Errors in diet. 2. Mild attacks of gastro-intestinal catarrh. Numerous observations in all countries show that these do predispose strongly to the disease. The stage of incubation seldom lasts over one to three days. The bacillus is during this time acquiring its growth.

The clinical record of cholera is typical and interesting. In its intensity of illness, the disease varies as do most infectious diseases, between the extremes of mildness and severity. The very mild cases can only be identified because of the fact that an epidemic exists. Such insignificant cases are designated, simple choleraic diarrhea. The symptoms presented are those of a fairly violent acute intestinal catarrh. The patient will pass without pain from 3 to 8 large watery stools in 24 hours. With this diarrhea there will exist malaise, complete loss of appetite, thirst, and at times there may be some symptoms of true cholera, such as vomiting, slight pain in the calves of the legs and diminished secretion of urine. This array of symptoms may last from a few days to a week or more, when recovery will gradually take place. In other cases the first mild diarrhea is succeeded at the end of about one or three days by a severe attack of cholera proper.

The mild form of cholera is succeeded in a gradual transition by the cases designated as "cholerine." Cholerine presents the

symptoms of a violent, rather sudden cholera morbus. Diarrhea is marked, the stools are large and watery and vomiting is a pronounced symptom. The attack often begins at night. With these digestive symptoms we have severe constitutional impression. Languor and depression are present. The pulse becomes small and accelerated, the extremities are cool, the voice grows weak and painful cramps occur in the calves. The urine grows scanty and albuminous. After these symptoms persist for a week, to two weeks, recovery takes place. In other cases however the course of the disease is varied by improvements and relapses. Death may take place early or be postponed for some time.

From these cases of medium severity, there is a continuous line of transition to the pronounced severe form of cholera proper. Our picture of cholera has been dire enough, but the dark shades have not been added thick enough.

Cholera proper may begin suddenly with the severest symptoms, and overwhelm the victim with its full force. As a rule however it is preceded by a state of vague ill feeling, and a brief premonitory diarrhea. This state lasts from one to three days and is replaced with suddenness by the severe symptoms of the second or "algid stage" or "cholera asphyxia." Great bodily weakness abruptly appears, with chilliness and vertigo.

Now the typical and characteristic gastro-intestinal symptoms declare themselves. The diarrhea grows violent. Fifteen, twenty or more dejections occur in twenty-four hours. They at first retain somewhat of a feculent character, but very soon present a characteristic resemblance to unclarified whey or water off of a decoction of rice or oatmeal. Sometimes the dejection is nearly clear, emitting an insipid spermatic odor. A single stool will measure a little less than half a pint. On standing they usually deposit a finely granular, grayish-white sediment. Their reaction is neutral or alkaline. They contain some albumen and a large amount of sodic chloride. Sometimes the evacuations are tinged with blood. On examining the sediment which falls, by means of the microscope, we find epithelium, triple phosphates and numerous micro-organisms. Of

these last a part are the comma bacilli, and a part are bacteria of putrefaction. If the comma bacilli be demonstrated, the diagnosis is absolute.

This violent diarrhea is soon followed by nausea and vomiting. This is sometimes constant. The vomitus is poured out, sometimes with much effort, sometimes with no distress. It consists in part of ingested liquids and in part of an actual transudation through the mucous membrane of the stomach and intestines. With the emesis there is often a very troublesome hiccough. With the diarrhea and vomiting there is complete anorexia and excessive thirst. The tongue has a thick dry coat. The abdomen is usually flat and soft, although it may be concave and hard.

As regards abdominal pain the authorities consulted differed widely. One stated that the pain was griping and of a most intense character; another that the abdominal pain consisted of a "feeling of heat and pressure" around the umbilicus. It is probable that this symptom is very variable.

With these pronounced and severe symptoms of alimentary canal disturbance, we have serious trouble in the circulatory system. At the beginning of an attack the action of the heart may be stimulated, but after a brief time cardiac weakness appears and continually increases. This becomes pronounced, the heart's action is just a flicker, the heart sounds very feeble. The pulse at the wrist grows very small and is usually accelerated. In severe cases the pulse vanishes completely after a few hours. This depression of circulation makes itself quickly evident in the appearance of the patient. The face and extremities grow cold and then ice-cold. Cyanosis of the face and head is marked, the lips are almost black. The surface temperature is reduced; the expired air has a temperature of only 81° F. In the rectum a febrile temperature may be observed, reaching 102° F. and higher. The eyes are sunken, the cheeks hollow. Death seems to have occurred while life is still present. The voice grows hoarse and feeble, respiration is laborious and superficial.

The mind may remain unclouded, but usually there is great apathy. Stupor and delirium are very rare, but few patients are restless and excited.

One of the most characteristic and at the same time, one of the most dreaded symptoms of cholera is violent and prolonged cramps in the muscles. They are intensely painful and consist of a tonic contraction of the muscles, particularly those of the calf of the legs, but also those of the toes, thighs, arms and hands. They occur spontaneously, or upon the slightest movement, last a few minutes, disappear and then recur at a longer or shorter interval. The precise reason of their occurrence is not yet known.

With the first appearance of the gastro-intestinal evacuations, the urine becomes scanty, concentrated, with abundant sediment and very often contains albumen. In many cases not one drop of urine reaches the bladder for days, and this condition persists till death or recovery.

Such symptoms as have just been reviewed, represent what is termed the algid stage of cholera and its duration is seldom more than one or two days. In the cases fatal most of them die in this stage. Death is ushered in by signs of extreme general prostration, and the patient dies in a few hours, or more frequently in the second half of the first day. In other cases the "stage of reaction" succeeds. The evacuations become less frequent, more feculent, and the vomiting ceases. Now the pulse becomes stronger and with its increase, the cyanosis and coolness of the extremities diminishes. The urine in a few days is again excreted, is almost invariably quite albuminous and usually contains casts and red blood-globules. If convalescence be uninterrupted, however, the urine soon becomes normal and the patient completely recovers in a week or two.

From this hasty recovery, constituting the stage of reaction departures are frequent. Convalescence is sometimes interrupted by relapses into the previous condition and sometimes death may ensue. Again a severe third stage may develop, accompanied with fever. This has been called, "cholera typhoid". In its clinical symptoms there are manifold variations; it may present an actually typhoid general condition with severe fever, or it may be distinguished by the development of the most diverse local inflammations, which

frequently lay the foundation for numerous sequelae.

Then we may have cholera typhoid of an uremic nature, with nervous symptoms, which cases are especially fatal.

Thus we can see that one stage of reaction does not always mean recovery and that any case of cholera before recovery or death may be prolonged and diversified by many serious symptoms and complications.

The average duration of an attack of cholera is from one to three days. Sometimes death occurs in less than six hours, and it is occasionally delayed a long time—in one case fifty days. Recovery from an attack of cholera may be complete in a short time and the patient may soon be able to return to his occupation. Again, there may remain after cholera a general debility, such as is not often seen after any other disease. The patient may remain emaciated, languid with a capricious appetite, obstinate gastralgia, wakefulness and an intellectual and moral dejection, which may persist for a long time. One attack of cholera furnishes no immunity against another and relapses are always to be feared.

PATHOLOGY:—In Cholera, if we try to find some correspondence between the pathological changes which control the process, and the symptoms, we shall not succeed. In the early stage of the disease, cholera is merely a severe local disease of the intestines. The mucous membrane is found in a state of catarrhal inflammation, being swollen, reddened and covered with a layer of tough, transparent mucus. Soon, however, this is washed off by an abundant transudation into the intestinal canal from the blood vessels within its walls. The intestinal coils are now found to contain a large amount of clear "rice-water" fluid, perfectly devoid of bile and of fecal odor.

The peritoneum over the intestines show a rose-red hue from congestion. These signs of inflammation of the mucous membrane deepen. The solitary follicles and Peyer's patches become swollen with edges of a livid hue, and frequently there are many small ecchymoses in the mucous membrane. The epithelial lining of the intestines is extensively desquamated. Ordinarily, these are all the appearances presented. In later stages of the disease the mucous membrane is necrosed and ulcerated in many places, and the intes-

tinal contents are no longer colorless, but sanious and bloody, with a foul odor.

At an early post-mortem the muscles exhibit strong and persistent rigor mortis and frequently they contract in such a way as to throw the corpse into some unusual position. The internal organs are, as we should suspect, dry, pale and anemic. The left ventricle is contracted and the blood lies mostly in the large veins of the body. It is thickened, but little clotted, and resembles the juice of huckleberries. The spleen is not enlarged, making an exception to the rule in infectious diseases. In the kidneys we find marked passive congestion. This is especially marked in the cortex. Under the microscope parenchymatous nephritis is found. The destruction of the epithelium lining the tubules is very extensive.

From what we now know of the disease, we can readily account for the intestinal symptoms. They are satisfactorily explained by the abnormal state of the intestinal wall due to the irritative presence of the comma bacilli. As, however, this bacillus is never found in the blood or in other parts of the body, we must seek some special cause to account for the grave symptoms of this disease.

The desiccation which the body undergoes because of the excessive liquid dejections cannot fail to affect the tissues, but as the circulatory disturbances and the cardiac failure may develop before large evacuations have occurred, this cannot fully explain the symptoms.

It is explained in two ways; It is possible that the cardiac and circulatory disturbances are the result of disturbance of the well-known sympathy between the abdominal organs and the heart. The second explanation is the one advanced by Koch. He believed that the life process of the comma bacillus created a toxic substance the absorption of which causes a part of the severe constitutional symptoms of cholera. The explanation of the complications is to regard them merely as secondary, not that cholera causes them, but that it is merely the occasion for their appearance.

DIAGNOSIS:—The symptoms of a pronounced case of cholera are so characteristic that the diagnosis at the time of an epidemic is

generally easy. In sporadic cases we must always be cautious—for violent intestinal disturbance, simulating perfectly the milder forms of cholera may be excited by other causes.

Cholera morbus and acute arsenical poisoning are two diseases which may give us symptoms wonderfully like cholera, and occurring during an epidemic of this disease are generally passed as cholera. Since Koch's discovery, the diagnosis of all doubtful cases becomes pretty sure, if we can demonstrate the presence of comma bacilli in the dejecta. This can be done by any physician having a microscope giving 600 to 1,000 diameters. If the material is fluid, it can be examined directly under the microscope without previous staining and again after drying and dyeing with aniline colors. It is true that these direct examinations are very unsatisfactory and often prove of no service, but at other times the comma bacillus can be readily found by this means. Such a procedure any physician could make.

The bacteria associated with the cholera bacillus are chiefly the bacterium *colis communis* or the *proteus vulgaris*, forms not in any sense difficult to distinguish from the cholera bacteria.

Likewise the physician could make the chemical test for the indol reaction. If he wished to go further he could make a plate culture and study the colonies developing on the plate.

Our bacteriologists make the subject a most difficult one. Having our culture tubes and plates prepared for us, the subject can be very greatly simplified and cultures can be made with but little trouble. The Aloe & Penfold Co., of Omaha, keep in stock the nutrient gelatine tubes, ready for inoculation and with them and a rudely devised incubator the subject can be studied fully and completely.

PROGNOSIS:—The prognosis is very grave and even in the mildest cases should be guarded, as a simple diarrhea may prove to be premonitory of a severe attack of cholera. There is no pestilence which has committed such frightful ravages among mankind as cholera. The mortality in many epidemics is frightful. All the inhabitants of a house or a street may be dead within a few days. In epidemics the

mortality ranges from 50 to 70 per cent. Death occurs in two-thirds of the fatal cases during the first days of the algid stage and about one-third during the period known as "cholera typhoid." Age seems to exert an influence on the prognosis. More children and old people perish than those of middle age. The better the hygienic surroundings about a patient the better the chances for that patient.

TREATMENT:—The treatment of cholera might engage our attention for sometime, but I shall not enter into its consideration as fully as the subject might justify. Individual prophylaxis is of the greatest importance. It has been definitely proved again and again that a mild intestinal catarrh will predispose to cholera and will aggravate the attack if cholera does occur. Therefore the slightest disturbance of the alimentary tract during an epidemic of cholera demands the greatest attention both to diet and medicine.

"By each person exercising and promoting cleanliness and moderation, each one will not only best protect himself, but also most efficiently support the efforts of the authorities in behalf of the public welfare." To prevent an epidemic of cholera, a pure water supply and strict cleanliness, in every sense, is absolutely necessary. It is not necessary in this paper to review the means for acquiring these essentials. All cholera discharges and articles soiled by them must be systematically disinfected. For the discharges a 5 per cent. solution of carbolic acid, and for the linen and bed-clothes, dry heat.

The cholera of 1892, in New York, has been given a careful review in the January number of *The American Journal of the Medical Sciences*, and I abstract profusely from the articles printed therein. On August 31, 1892, a vessel belonging to The Hamburg American Steamship Company arrived in the New York harbor, reporting 22 deaths from cholera among 24 patients, the first case occurring on the first day after leaving Hamburg. The vessel was taken in hand by the health authorities and only one case of cholera later developed among its passengers. This patient died.

The passengers were kept on shipboard, the immigrants received baths, having been previously rubbed with a bountiful supply of

green soap. The crew's quarters and the steerage were scrubbed and washed out with a 1:500 solution of corrosive sublimate. Fumigation with sulphur was carried out. The baggage and clothing were disinfected by sulphur, super-heated steam, and, when injury would not be done, by corrosive sublimate solution. Soiled bedding and clothing were burned in the furnace. Lastly, fresh water was supplied and only used after boiling.

All the sick persons on the vessel were conveyed to Hoffman's Island. This island will accommodate about 800 persons. There is no soil upon the island, asphalt covering the entire space, thus affording opportunity for thorough flushing with disinfectants. A high fence surrounds the island on all sides. The closets are provided with pans containing disinfectants, so that untreated dejecta cannot have access to the sea.

There are ample arrangements for the disinfection of clothing and effects by superheated steam or by exposure to burning sulphur for six hours, the clothing being loosely unfolded in bins. During the entire quarantine there were 111 cases of illness of all kinds treated at Hoffman's Island. Fifty cases were transferred to Swinburne Island for treatment, including about thirty cases of measles.

At Swinburne Island there are ten wards, accommodating about three hundred persons. The buildings are old, but in good repair and well adapted to all requirements. The treatment of the cholera patients there—for all cholera patients were transferred to this island—expresses the latest treatment for cholera and will, I am sure, be of interest. The treatment of the disease was essentially surgical in bearing, especially in the stage of asphyxia.

In the premonitory diarrhea, if there was no collapse, the first step was to clear the bowels, which was done by the administration of 10 grains of calomel by the mouth, and this was repeated every hour until three doses were taken or thorough evacuation secured. Afterward one-half grain was administered every two hours. Stimulants were used as required, preferably brandy, and generally administered hypodermatically.

In the stage of asphyxia—in the algid stage,—the stomach and

bowels were thoroughly washed out. For the stomach the Faucher tube was used for the purpose of introducing the 1:1,000 warm solution of hydrochloric acid. The procedure was repeated every two hours. The intestines were then washed out with a two per cent. aqueous solution of tannic acid, half a gallon being used at a time, at a temperature of 108 or 109° F. and this was likewise repeated every two hours. A long (two foot) rectal tube was employed, the patient lying upon the back, and gentle massage was made if there was any difficulty in the passage of the fluid beyond the ileo-cecal valve. The purpose of this procedure was, first, to wash out the intestines; second, to precipitate the ptomaines, and third, to warm the body. After each injection the body temperature rose from one to three degrees.

When the pulse began to disappear and respiration became shallow, then hypodermo-clysis was resorted to. The solution employed was

℞ Sodium chlorid.....3 parts
 Brandy.....10 "
 Sterilized water kept at a temperature
 of 104° F.....1,000 parts.

One quart of this was used for an adult and it was injected into the flanks at about the eighth rib and was repeated every second to fifth hour, according to the necessity of the case. The largest amount used in any one case was eleven quarts. In several cases inhalation of oxygen at the rate of a gallon every hour, watching the heart, were resorted to.

No nourishment was administered while vomiting persisted. At other times, peptonized beef, champagne and milk, with carbonated water 3 to 1, were employed. The distressing cramps were avoided in all but two cases, by placing the patients in a warm atmosphere, by building a tent over them, so that they would be in a current of hot air. During convalescence a simple and nourishing diet was insisted on.

The work done at Swinburne Island can be summed up as follows:

Fifty-six suspected cases were received, all of which, excepting ten, presented marked premonitory symptoms. All of the cases entered at the island received a hot bath on admission, and were kept in bed. All of them drank freely of hydrochloric acid lemonade, of the strength of 1 to 1000, and none of these cases thus treated had further trouble.

Seventy-two cases of Asiatic cholera were treated at the island, eight of them being light cases. Of these cases, 20 died, six of them within two hours after admission. Of these twenty deaths, three can be attributed to other causes, because they had recovered from the stage of asphyxia; two of these died from a pneumonia of the right lower lobe, one died from nephritis. So that but 17 deaths are justly attributable to the cholera, all dying in the period of asphyxia. A death rate of 23 per cent only.

It is especially notable that opium had no place in the treatment, the laboratory experiments of Koch showing conclusively that the administration of this drug favors the development and progress of the disease.

The virulence of the epidemic of 1892 was shown by the fact that a large number of cases became fatal within four hours after admission, thus rendering the time of efficient service a brief one. The bodies of all persons dying from cholera were cremated, as well as those of twenty-four persons who died upon the steamship while in New York harbor.

After the arrival of the first vessel, with cholera on board, six other vessels arrived all reporting "cholera" during the voyage. All were taken in hand by the authorities at Hoffman's Island and the seventy-two cases of cholera transferred to Swinburne Island.

Five days after the disease appeared in the harbor, the first person to be affected with cholera in New York City was taken ill and died in about 36 hours. During the four weeks following, six other cases occurred in New York and one case in New Brunswick, N. J., in all of which the cholera spirillum was found. In three other cases in which no biological examination was made, the associations and clinical history justified a diagnosis of Asiatic cholera,

thus making a total of 11 cases recognized as Asiatic cholera occurring in and about New York City. These eleven cases were distributed at various parts of the city and strict quarantine of the houses in which they lived no doubt kept the disease within bounds. How and why these eleven cases were selected as a habitat for the comma bacillus is impossible to be explained. No satisfactory source of infection could be discovered. Of the eleven cases, nine died. Four of the persons affected were butchers or dealers in animal foods. A striking fact.

In conclusion, let me call attention to the work of Prof. Pasteur in his experiments for the prevention of cholera by inoculation of cholera virus.

Pasteur, through Prof. Haffkine, has vaccinated over forty persons for cholera. Two inoculations have been made in each case. Four patients received three. The first inoculation is of attenuated virus which has been preserved for a long time in phenic acid and consequently contains the venom produced by dead microbes only. The second inoculation was made with living but attenuated virus and the third with exalted or pure culture. But slight reaction follows.

A number of the people who have been inoculated so far have exposed themselves to every danger of catching cholera but none have taken it. M. Haffkine, M. Haukin and a French journalist have swallowed concentrated germ solutions of cholera without having experienced the slightest inconvenience from the experiment.

More work is to be done, however, before it can be announced positively that Prof. Pasteur's experiments will be of service to the world.

